4.0 ENVIRONMENTAL PROGRAM INFORMATION

The environmental monitoring and compliance programs for the Nevada Test Site (NTS) and several offsite facilities consist of radiological and nonradiological monitoring and environmental permit and operations compliance.

4.1 RADIOLOGICAL MONITORING

There are two radiological monitoring programs associated with the NTS, one onsite and the other offsite. The onsite program is conducted by Bechtel Nevada (BN), the operations & maintenance contractor for the NTS. BN is responsible for NTS environmental surveillance and effluent monitoring. Several other organizations, such as the Lawrence Livermore National Laboratory, Los Alamos National Laboratory (LANL), Desert Research Institute (DRI), International Technology Corp., and the U. S. Environmental Protection Agency (EPA) also make radiological measurements onsite. The offsite program is conducted by the EPA's Center for Environmental Restoration, Monitoring and Emergency Response of the Radiation & Indoor Environments National Laboratory in Las Vegas, Nevada (R&IE-LV) with support from the DRI.

ONSITE MONITORING

At the NTS radiological effluents may originate from tunnels, from underground test event sites (at or near surface ground zeros), and from facilities where radioactive materials are either used, processed, stored, or discharged. All of these sources have the potential to, or are known to discharge radioactive effluents into the environment. Two types of monitoring operations are used for these sources: (1) effluent monitoring, which measures radioactive material collected at the point of discharge; and (2) environmental surveillance, which measures radioactivity in the general environment.

Table 4.1 is a summary of the routine environmental surveillance program, as of the end of 1996. Air sampling is conducted for radioactive particulates, noble gases, and tritiated water (HTO) vapor. The sampling locations are shown in Figure 4.1. Figure 4.2 shows the locations where ambient gamma radiation monitoring is conducted on the NTS using thermoluminescent dosimeters (TLDs). Water samples are collected from springs, groundwater wells, well reservoirs, water taps, and waste disposal ponds (Figures 4.3 and 4.4).

CRITERIA

U.S. Department of Energy (DOE) Order 5400.1, "General Environmental Protection Program," establishes environmental protection program requirements, authorities, and responsibilities for DOE operations. These mandates require compliance with applicable federal, state, and local environmental protection regulations. Other DOE directives applicable to environmental monitoring include DOE Order 5480.11, "Radiation Protection for Occupational Workers"; DOE

Click to view figure 4.1.

Figure 4.1 Air Sampling Stations on the NTS - 1996

Click to view figure 4.2.

Figure 4.2 TLD Stations on the NTS (+) - 1996

Click to view figure 4.3.

Figure 4.3 Supply Well and Potable Water Sampling Stations on the NTS - 1996

Click to view figure 4.4.

Figure 4.4 Surface Water Sampling Locations on the NTS - 1996

Order 5480.1B, "Environment, Safety, and Health Program for DOE Operations"; DOE Order 5484.1, "Environmental Protection, Safety, and Health Protection Information Reporting Requirements"; DOE Order 5400.5, "Radiation Protection of the Public and the Environment"; and DOE/EH-0173T, "Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance."

EFFLUENT MONITORING

During 1996, effluent monitoring at the NTS involved several operational facilities and some inactive locations. Due to the continuation of the moratorium on nuclear testing throughout 1996, effluent monitoring for nuclear tests was not required.

LIQUID EFFLUENT MONITORING

Radiologically contaminated water was discharged from E Tunnel in Rainier Mesa (Area 12). N and T Tunnels have been sealed to prevent such discharges. A grab sample was collected quarterly from the tunnel's effluent discharge point and from the tunnel's containment pond. These samples were analyzed for tritium (^{3}H), gross beta, ^{238}Pu, $^{239+240}Pu$ and gamma emitters. In addition, an annual sample was analyzed for ^{90}Sr. Tritium was the radionuclide most consistently detected at the tunnel sites. Other radionuclides were detected infrequently. Flow data obtained from the Defense Special Weapons Agency (formerly the Defense Nuclear Agency) was used to calculate the total volume discharged. Annual average radioactivity concentrations were calculated from the quarterly measurements. From these the total amount of radioactivity in the effluent was obtained.

Water pumped from wells drilled to obtain data for characterization of the NTS groundwater, was discharged into containment ponds. The total volume of water was obtained from the pond area and the water depth. An average concentration of tritium in water (HTO) was used to obtain the total volume of water discharged from the characterization wells. Tritium was the only radionuclide detected in these water samples.

Typical minimum detectable concentrations for water analyses were:

- Gross α: 1.4×10^{-9} µCi/mL (5.2×10^{-2} Bq/L)
- Gross ß: 1.2×10^{-9} µCi/mL (4.4×10^{-2} Bq/L)
- Gamma Spectroscopy: 0.1 to 20×10^{-7} µCi/mL (0.3 - 74 Bq/L) (Using a ^{137}Cs standard)
- Tritium (conventional): 7.2×10^{-7} µCi/mL (27 Bq/L)
- Tritium (enrichment): 1.4×10^{-8} µCi/mL (0.52 Bq/L)
- ^{90}Sr: 2.9×10^{-10} µCi/mL (1.1×10^{-2} Bq/L)
- ^{226}Ra: 1×10^{-9} µCi/mL (0.074 Bq/L)
- ^{238}Pu: 2×10^{-11} µCi/mL (7.4×10^{-4} Bq/L)
- $^{239+240}Pu$: 2×10^{-11} µCi/mL (7.4×10^{-4} Bq/L)

AIRBORNE EFFLUENT MONITORING

As the moratorium on nuclear testing, established in 1992, was continued throughout the year, airborne effluent monitoring was not required.

ENVIRONMENTAL SURVEILLANCE

Environmental surveillance was conducted onsite throughout the NTS. Equipment at fixed locations continuously sampled the ambient air to monitor for radioactive material content. Surface water and groundwater samples were routinely collected at pre-established locations and analyzed for radioactivity. Ambient gamma exposures were measured with TLDs placed at fixed locations.

AIR MONITORING

The environmental surveillance program operated samplers that were designed to detect airborne radioactive particles, radioactive noble gases, and ^{3}H as water vapor in the form $^{3}H^{3}HO$ or ^{3}HHO (HTO).

Air sampling units used to measure radioactive particulates and halogens were operated at 49 stations on the NTS (Figure 4.1) during 1996. These stations included 17 inside radioactive waste management facilities. By the end of the year, the number of stations had been reduced to 45 as the RWMS perimeter stations were reduced by 4. Access, worker population, geographical coverage, presence of radioactivity, and availability of electrical power were considered in site selection. During this year, air samplers powered by solar photovoltaic-battery systems were operated in ten contaminated areas where there was no commercial power.

An air sampling unit consisted of a positive displacement pump drawing approximately 140 L/min (5 cfm) of air through a nine-centimeter diameter Whatman GF/A glass-fiber filter for trapping particulates. Due to the moratorium on testing, the use of charcoal cartridges behind the particulate filter was suspended. The particulate filter was mounted in a plastic, cone-shaped sample holder. A dry-gas meter measured the volume of air sampled during the sampling period (typically seven days). The unit collected approximately 1,400 m^3 of air during the seven-day sampling period.

The filters were held for no less than five nor more than seven days prior to analysis to allow naturally occurring radon and its progeny to decay. Gross alpha counting (beginning in June 1996) and gross beta counting were performed with a gas-flow proportional counter for 20 min. The respective minimum detectable concentrations (MDCs) for these analyses, assuming typical counting parameters, were 9.8×10^{-16} µCi/mL (36 µBq/m^3), using a ^{239}Pu calibration source and 3.3×10^{-15} µCi/mL (120 µBq/m^3), using a ^{90}Sr calibration source. Gamma spectroscopy of the particulate filter was accomplished using germanium detectors with an input to a 2,000-channel spectrometer. This spectrometer was calibrated at one keV per channel from 0.02 to 2 MeV using a National Institute of Standards and Technology traceable mixed radionuclide source. The MDC for ^{137}Cs using this system was 8.2×10^{-15} µCi/mL (30 mBq/m^3).

Weekly air samples collected for radioactive waste operations in Areas 3 and 5 were composited on a monthly basis and radiochemically analyzed for ^{238}Pu and $^{239+240}Pu$. The weekly air filters collected from all other locations were composited quarterly and analyzed for plutonium. The filters were subjected to an acid dissolution and an ion-exchange recovery on a resin bed. Plutonium was eluted from the resin, precipitated, and collected on a filter for analysis. The chemical yield of the plutonium was determined with an internal ^{242}Pu tracer. Alpha spectroscopy was performed utilizing a solid-state silicon surface barrier detector. The MDC for ^{238}Pu and $^{239+240}Pu$ was approximately 1.6×10^{-17} µCi/mL (0.61 µBq/m^3).

Initially, noble gases were continuously sampled at ten locations and analyzed for ^{85}Kr and ^{133}Xe. This network was reduced to three locations by the beginning of the year, and ^{133}Xe analysis was discontinued. The noble gas samplers maintained a steady sampling flow rate of approximately 0.08 L/min. These sampling units were housed in a metal tool box with three metal air bottles attached to the sampling units with short hoses. A vacuum was maintained on the first bottle by pumping the sample into the other two bottles. The two collection bottles were exchanged weekly and contained a sample volume of about 400 L each at standard conditions.

The noble gases were separated from the atmospheric sample by cryogenic gas fractionation. Water and carbon dioxide were removed at room temperature, and the krypton and xenon were collected on charcoal at liquid nitrogen temperatures. These gases were transferred to a molecular sieve where they were separated from any remaining gases and from each other. The krypton was transferred to a scintillation vial and counted on a liquid scintillation counter. The MDC for ^{85}Kr was 9.6 x 10^{-12} µCi/mL (0.33 Bq/m^3).

Airborne HTO vapor was initially monitored at 16 locations throughout the NTS, but this was reduced to 12 locations during the year. For this monitoring, a small pump continuously drew air into the sampler at approximately 0.4 L/min, the total volume being measured with a dry gas meter. The HTO vapor was removed from the air stream by a silica-gel drying column followed by a drierite column. These columns were exchanged every two weeks. Appropriate aliquots of condensed moisture were obtained by heating the silica gel. The tritium activity was then obtained by liquid scintillation counting. The MDC for HTO vapor analysis was 3.2 x 10^{-12} µCi/mL (0.12 Bq/m^3) of air at standard conditions.

AMBIENT GAMMA MONITORING

Ambient gamma monitoring was conducted at 169 stations within the NTS (Figure 4.2), reduced to 160 by the end of the year through use of TLDs. The dosimeter used was the Panasonic UD-814AS environmental dosimeter, consisting of four elements housed in an air-tight, water-tight, ultraviolet-light-protected case. One element, made of lithium borate, was only slightly shielded in order to measure low-energy radiation. The other three elements, made of calcium sulfate, were shielded by 1,000 mg/cm^2 of plastic and lead to monitor penetrating gamma radiation only. TLDs were deployed in a holder placed about one meter above the ground and exchanged quarterly. Locations were chosen at the site boundary, where historical monitoring has occurred, or where operations or ground contamination occurred.

WATER MONITORING

Water samples were collected from selected potable tap-water points, water supply wells, natural springs, open reservoirs, sewage lagoons, and containment ponds. The frequency of collection and types of analyses performed for these types of samples are shown in Table 4.1. Sampling locations are shown on Figures 4.3 and 4.4, above.

A 500-mL aliquot was taken from the water sample, placed in a plastic bottle, and counted for gamma activity with a germanium detector. A 2.5-mL aliquot was used for ^{3}H analysis by liquid scintillation counting. The remainder of the original sample was evaporated to 15 mL, transferred to a stainless steel counting planchet, and evaporated to dryness after the addition of a wetting agent. Alpha and/or beta analyses were accomplished by counting the planchet samples for 100 minutes in a gas-flow proportional counter.

Tritium enrichment analyses were performed by concentrating the volume and tritium content of a 250-mL sample aliquot to 10 mL by electrolysis of the basic solution and analyzing a 5-mL portion of the concentrate by liquid scintillation counting.

The ^{226,228}Ra concentrations were determined from low-background gamma spectrometric analyses of radium sulfate. The samples were prepared by adding a barium carrier and ^{225}Ra tracer to 800 mL of sample, precipitating the barium and radium as a sulfate, separating the precipitate, and analyzing it by counting for 500 min in a low-level gamma spectroscopy facility.

The radiochemical procedure for plutonium was similar to that described in Section 4.1. Alpha spectroscopy was used to measure any ^{238}Pu, $^{239+240}$Pu, and the ^{242}Pu tracer present in the samples.

WASTE MANAGEMENT SITE MONITORING

Environmental surveillance on the NTS included Radioactive Waste Management Sites (RWMS). These sites are used for the disposal of low-level radioactive waste from the NTS and other DOE facilities. Shallow-land disposal in trenches and pits was done at the Area 5 RWMS (RWMS-5) and in subsidence craters at the Area 3 RWMS (RWMS-3).

RWMS-5 monitoring began with 17 permanent air particulate sampling stations, 9 permanent HTO vapor sampling stations, and 26 TLD stations placed inside and around the site. These were later changed to 7 air particulate and 4 HTO samplers, with no change in TLDs. The RWMS-3 is monitored by 4 air particulate and 1 HTO sampling stations and with several TLD stations located nearby.

SPECIAL ENVIRONMENTAL STUDIES

The Basic Environmental Compliance and Monitoring Program (BECAMP) used the past accomplishments of two former programs at the NTS, the Nevada Applied Ecology Group and the Radionuclide Inventory and Distribution Program. These programs were used in efforts to assess changes over time in the radiological conditions on the NTS, update human dose-assessment models, and provide information to DOE Nevada Operations Office (DOE/NV) for site restoration projects and compliance with environmental regulations. Most BECAMP missions were discontinued in 1996.

In 1995, the ecological monitoring studies conducted under BECAMP over the past eight years were reviewed. These studies monitored the flora and fauna on the NTS to assess changes in ecological conditions over time. In 1996, a new program entitled Ecological Monitoring and Compliance (EMAC) program was instituted. It is described in Section 4.2 of this Chapter.

OFFSITE MONITORING

Under the terms of an Interagency Agreement between DOE and EPA, EPA's Office of Radiation and Indoor Air assumed responsibility for the Offsite Radiation Safety Program in areas surrounding the NTS. In October 1996, these activities were assumed by the R&IE-LV, a component of the Office of Radiation and Indoor Air. The primary activity of the R&IE-LV program is routine monitoring of potential human exposure pathways. Public information and community assistance constitute secondary activities.

Due to the continuing moratorium on nuclear weapons testing, only three readiness exercises were conducted in 1996. For each of the three tests, R&IE-LV senior personnel served on the Test Controller's Scientific Advisory Panel and on the EPA offsite radiological safety staff.

Routine offsite environmental monitoring for compliance with National Emission Standards for Hazardous Air Pollutants (NESHAPs) and with DOE orders 5400.1 and 5400.5 continued throughout 1996.

Environmental monitoring networks, described in the following subsections, measure radioactivity in air, milk, and groundwater. These networks monitor the major potential pathways for transfer of radionuclides to man. Ambient gamma radiation levels are monitored using Reuter-Stokes pressurized ion chambers (PICs) and Panasonic TLDs. Groundwater on and around the NTS and in other states is monitored in the Long-Term Hydrological Monitoring Program (LTHMP). Data from these networks are used to calculate an annual exposure to the offsite residents.

A decreased number of Community Technical Liaison Programs (CTLPs), formerly Community Radiation Monitoring Program, stations that were established at prominent locations in a number of offsite communities continued to operate. The CTLP stations contain samplers for several of the monitoring networks and are managed by local residents. The DRI is a cooperator with R&IE-LV in the CTLP.

AIR MONITORING

The inhalation of radioactive airborne particles can be a major pathway for human exposure to radiation. The atmospheric monitoring networks are designed to detect environmental radioactivity from both NTS and non-NTS activities. Data from atmospheric monitoring can be used to determine the concentration and source of airborne radioactivity and to project the fallout patterns and durations of exposure to man.

The Air Surveillance Network (ASN) was originally designed to monitor the areas within 350 km (220 mi) of the NTS. Due to the current moratorium on nuclear weapons testing, DOE began reducing the area of the offsite monitoring networks to within approximately 130 km (80 mi) of the NTS. Station location depends in part on the availability of electrical power and a resident willing to operate the equipment.

At the beginning of 1996, the ASN consisted of 20 continuously operating sampling stations. During the year, two stations were discontinued and two new stations were added. The current network is shown in Figure 4.5. High-volume air samplers were operational at five of the stations at the beginning of the year and a sixth was added in April. Dismantling of the Standby ASN that began last year was completed this year.

The low-volume air samplers at each station are equipped to collect particulate radionuclides on 5-cm (2.0-in) diameter glass-fiber filters at a flow rate of about 80 m^3 (2,800 ft^3) per day. Filters are changed weekly (approximately 560 m^3 or 20,000 ft^3 of air sampled). Activated charcoal cartridges placed directly behind the filters to collect gaseous radioiodine are changed at the same time as the fiber filters. High-volume air samplers at selected stations collect particulate on 20-x 25-cm (8-x 10-in) glass-fiber filters at a flow rate of approximately 1,600 m^3 (58,000 ft^3) per day. Duplicate air samples are collected from two routine ASN stations each week. The duplicate samplers operate at randomly selected stations for three months and are then moved to new locations. One duplicate high-volume sampler is operated in the same manner as the duplicate low-volume sampler. High-volume samples are collected every two weeks (approximately 22,000 m^3 or 800,000 ft^3 of air is sampled).

At the R&IE-LV laboratory, both the glass-fiber filters and the charcoal cartridges were promptly analyzed by high-resolution gamma spectrometry. Each of the glass-fiber filters was then analyzed for gross alpha and gross beta activity 7 to 14 days after sample collection to allow time for the decay of naturally occurring radon/thoron progeny. Filters from high-volume air samplers were analyzed using high-resolution gamma spectrometry and then were composited by month for each station and analyzed for plutonium isotopes.

WATER MONITORING

As part of the LTHMP, R&IE-LV personnel routinely collect and analyze water samples from locations on the NTS and from sites in the surrounding offsite areas. Due to the scarcity of surface waters in the region, most of the samples are groundwater, collected from existing wells. Samples from specific locations are collected monthly, biannually, annually, or biennially in accordance with a preset schedule. Many of the drinking water supplies used by the offsite population are represented in the LTHMP samples. Results for the LTHMP samples, including those from sites in other states (described in Chapter 2) are discussed in Chapter 9.

MILK SURVEILLANCE NETWORK (MSN)

Milk is an important source for evaluating potential human exposures to radioactive

Click to view figure 4.5.

Figure 4.5 ASN and PIC Station Locations - 1996 material. It is one of the most universally consumed foodstuff and certain radionuclides are readily traceable through the chain from feed or forage to the consumer. This is particularly true of radioiodine isotopes which, when consumed in sufficient quantities, can cause impairment of thyroid function. Because dairy animals consume vegetation representing a large area and because many radionuclides are transferred to milk, analysis of milk samples yields information on the deposition of small amounts of radionuclides over a relatively large area.

The MSN includes commercial dairies and family-owned milk cows and goats representing the major milksheds within 300 km (186 mi) of the NTS. The 11 locations comprising the MSN at the beginning of 1996 and any changes are shown in Figure 4.6. Samples were collected from only ten of these locations because the Hafen Ranch in Ivins, Utah, was not milking during the collection period.

Raw milk was collected in 3.8-L (1-gal) cubitainers from each MSN location in July and preserved with formaldehyde. The samples were analyzed by high-resolution gamma spectrometry for gamma emitters and for ^{89}Sr and ^{90}Sr by radiochemical separation and beta counting. This network was designed to monitor areas adjacent to the NTS, which could be affected by a release of activity, as well as from areas unlikely to be so affected.

BIOMONITORING

The biomonitoring program for radionuclides has been discontinued. A summary report on the program is in preparation.

THERMOLUMINESCENT DOSIMETRY NETWORK

An essential component of environmental radiological assessments is external dosimetry. Such dosimetry is used to determine both individual and population exposure to ambient radiation, natural or otherwise.

The primary purpose of EPA's offsite environmental dosimetry program is to establish dose estimates to populations living in the areas surrounding the NTS. Panasonic Model UD-814 TLDs are used for environmental monitoring. The UD-814 consists of one element of $Li_2B_4O_7$:Cu and three elements of $CaSO_4$:Tm phosphors. The $CaSO_4$:Tm elements are behind a filter of approximately 1,000 mg/cm^2. An average of the corrected values for the latter three elements gives the total exposure for each TLD. For quality assurance purposes, two UD-814 TLDs are deployed at each fixed environmental station location. The TLDs are exchanged quarterly.

In addition to a fixed environmental TLD, EPA deploys personnel TLDs to individual volunteers, predominantly CTLP station managers and their alternates, living in areas surrounding the NTS.

Panasonic Model UD-802 TLDs are used for personnel monitoring. The UD-802 consists of two elements each of $Li_2B_4O_7$:Cu and $CaSO_4$:Tm phosphors. The phosphors are behind filters of approximately 17,300,300 and 1,000 mg/cm^2 respectively. With the use of different phosphors and filtrations, a dose algorithm can be applied to ratios of the different element responses. This process defines the radiation type and energy and provides data for assessing an absorbed dose equivalent to the participating individuals. These TLDs are also exchanged quarterly.

An average daily exposure rate was calculated for each quarterly exposure period and the average of the four values was multiplied by 365.25 to obtain the total annual exposure for a station.

New computers and software were installed in 1996 to increase report options, and further hardware upgrades will be completed in 1997.

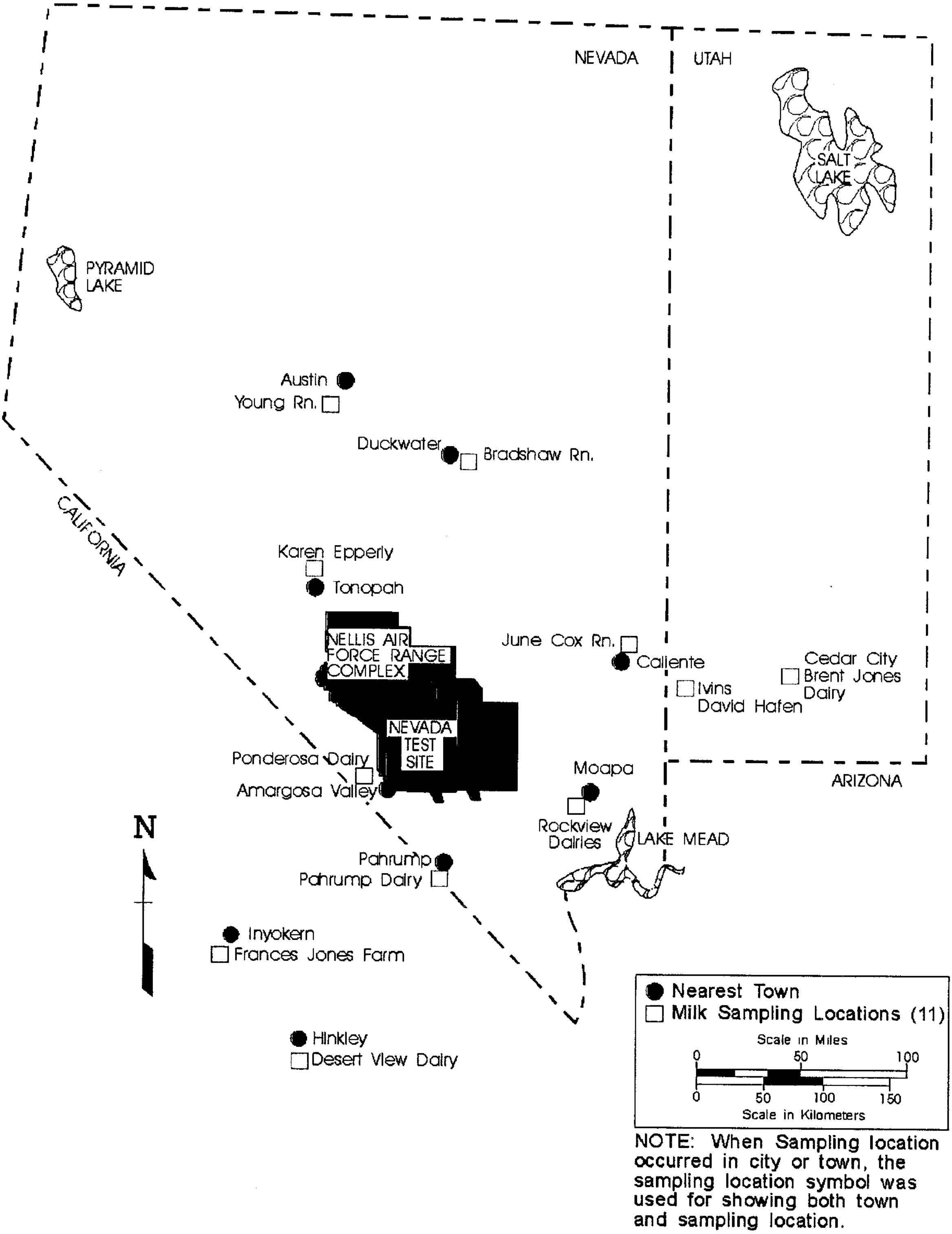


Figure 4.6 MSN Stations - 1996

In 1996, the TLD program consisted of 51 fixed environmental monitoring stations and 26 offsite personnel. Henderson and Boulder City, Nevada, and Furnace Creek, California, were added to the network in the fourth quarter. Figure 4.7 shows the fixed environmental TLD monitoring stations and the location of personnel monitoring participants.

PRESSURIZED ION CHAMBER (PIC) NETWORK

The PIC network uses Reuter-Stokes models 1011, 1012, and 1013 PICs. The PIC is a spherical shell filled with argon gas at 25 times atmospheric pressure. In the center of the chamber is a spherical electrode with an electrical charge opposite to the outer shell. When gamma radiation penetrates the sphere, ionization of the gas occurs and the negative ions are collected by the center electrode. The current thus generated is proportional to the radiation exposure.

The PIC measures gamma radiation exposure rates, and because of its sensitivity, may detect low-level exposures not detected by other monitoring methods. The primary function of the PIC network is to detect changes in ambient gamma radiation due to human activities. In the absence of such activities, ambient gamma radiation rates naturally differ among locations as they may change with altitude (cosmic radiation), with radioactivity in the soil (terrestrial radiation), and may vary slightly within a location due to weather patterns.

Near real-time telemetry-based data retrieval is achieved by a remote automated data acquisition system which collects data from the PIC and transmits it through the Geostationary Operational Environmental Satellite directly to a LANL receiver and then to R&IE-LV by a dedicated telephone line. In addition to telemetry retrieval, PIC data are also recorded on either magnetic tapes or magnetic cards which provide a backup for the telemetry data.

There are 27 PICs located in communities around the NTS and one in Mississippi, which provide near real-time estimates of gamma exposure rates. Stations at Henderson and Boulder City, Nevada, were added to the network in the fourth quarter of 1996. The PIC at Boulder City was vandalized after only five days of data collection. Another site in Boulder City is being proposed to prevent future incidents. The locations of the PICs are shown in Figure 4.5, for stations around the NTS.

INTERNAL DOSIMETRY NETWORK

This network has been discontinued, and a summary report of the program is in preparation.

COMMUNITY TECHNICAL LIAISON PROGRAM (CTLP)

Because of the successful experience with the Citizen's Monitoring Program during the purging of the Three Mile Island containment in 1980, the Community Radiation Monitoring Program (CRMP) was begun. Because of reductions in the scope of monitoring, the CRMP was changed to the CTLP. It now consists of stations located in the states of Nevada and Utah. In 1996, there were 15 stations located in these two states. The CTLP is a cooperative project of the DOE, EPA, and DRI.

DOE/NV sponsors the program. The EPA provides technical and scientific direction, maintains the instrumentation and sampling equipment, analyzes the collected samples, and interprets and reports the data. The DRI administers the program by hiring the local station managers and alternates, securing rights-of-way, providing utilities, and performing additional quality assurance checks of the data. Shown in Figure 4.8 are the locations of the CTLP stations.

Each station is operated by a local resident. In most cases, this resident is a high-school science teacher. Samples are analyzed at the R&IE-LV. Data interpretation is provided

Click to view figure 4.7.

Figure 4.7 Location of TLD Fixed Stations and Personnel Monitoring Participants - 1996

Click to view figure 4.8

Figure 4.8 CTLP Station Locations - 1996 by DRI to the communities involved. All of the 15 CTLP stations had one of the samplers for the ASN and Noble Gas and Tritium Surveillance Network, on either routine or standby status, and a TLD. In addition, a PIC and recorder for immediate readout of external gamma exposure and a recording barograph are located at the station. All of the equipment is mounted on a stand at a prominent location in each community so the residents can become aware of the surveillance and, if interested, can check the data. Also, computer-generated reports of the PIC data are issued monthly for each station.

4.2 NONRADIOLOGICAL MONITORING

The 1996 nonradiological monitoring program for the NTS included onsite sampling of various environmental media and substances for compliance with federal and state regulations or permits and for ecological studies. The EMAC program, formerly part of BECAMP, performed habitat mapping in the southern third of the NTS, characterized NTS springs, monitored man-made water sources, conducted wild horse and chukar surveys, prepared a biological monitoring plan for the Hazardous Materials Spill Center (HSC), and surveyed for several former candidate species for federal listing under the Endangered Species Act. In 1996, nonradiological monitoring was conducted for four series of tests conducted at the HSC on the NTS.

Nonradiological monitoring of non-NTS DOE/NV facilities was conducted at three offsite facilities. This monitoring was limited to wastewater discharges to publicly owned treatment works.

NTS OPERATIONS MONITORING

ROUTINE MONITORING

As there were no industrial-type production facility operations on the NTS, there was no significant production of nonradiological air emissions or liquid discharges to the environment. Sources of potential contaminants were limited to construction support and NTS operational activities. This included motor pool facilities; large equipment and drill rig maintenance areas; cleaning, warehousing, and supply facilities; and general worker support facilities (including lodging and administrative offices) in the Mercury Base Camp, Area 12 Camp, and to a lesser extent in Area 20 and the NTS Control Point Complex in Area 6. The HSC in Area 5 is a source of potential release of nonradiological contaminants to the environment, depending on the individual tests conducted. In 1996, there were four series of tests, involving 28 different chemicals, conducted at this facility. Monitoring was performed to assure that the contaminants did not move to offsite areas. Since these HSC monitoring functions are performed by the R&IE-LV at the NTS boundary, they are described in Section 4.2. Routine nonradiological environmental monitoring on the NTS in 1996 was limited to:

- Sampling of drinking water distribution systems and water haulage trucks for Safe Drinking Water Act and state of Nevada compliance.
- Sewage lagoon influent and E Tunnel discharge sampling for compliance with state of Nevada operating permit requirements.
- Sampling of electrical equipment oil, soil, water, surfaces, and waste oil for the presence of polychlorinated biphenyls as part of Toxic Substance Control Act compliance.
- Asbestos sampling in conjunction with asbestos removal and renovation projects and in accordance with occupational safety and NESHAPs compliance.
- Sampling of soil, water, sediment, waste oil, and other media for Resource Conservation and Recovery Act (RCRA) constituents.

ECOLOGICAL MONITORING

The BECAMP was redesigned to address changes in DOE/NV missions and DOE’s commitment to manage land and facility resources based on the principles of ecosystem management and sustainable development. A comprehensive and adaptable guidance document for ecological monitoring was completed in May. The new program is designated as EMAC. The ecological monitoring tasks which were selected for 1996 included vegetation mapping within the range of the desert tortoise, characterizing the natural springs on the NTS, conducting a census of horse and chukar populations, and periodically monitoring man-made water sources to assess their affects on wildlife. The Environmental Assessment for the HSC (formerly the Liquefied Gaseous Fuels Spill Test Facility) calls for ecological monitoring of certain spill tests, and a monitoring plan was developed and implemented in 1996.

CHARACTERIZATION OF NTS SPRINGS

From June through December, biologists visited 25 natural water sources at the NTS to determine if these mesic habitats qualify for jurisdictional wetlands protection. These included all known springs, seeps, tanks (natural rock basins), and ephemeral ponds. The presence of wetland plants, wetland hydrology, and hydric soils (all indicators for jurisdictional wetlands) was recorded at each site. A summary report of all findings will be completed in 1997. Permits would be required under section 404 of the Clean Water Act before any alterations of the aquatic habitat could be made at any of the NTS sites which qualify as jurisdictional wetlands.

MONITORING OF MAN-MADE WATER SOURCES

Quarterly monitoring of man-made water sources began in April to identify any possible impacts of these open water sources on wildlife. These water sources include plastic-lined, cement-lined, and/or earthen sumps, containment ponds, and sewage ponds located throughout the NTS.

HSC MONITORING

A document titled “Biological Monitoring Plan for Hazardous Materials Testing at the Liquefied Gaseous Fuels Spill Test Facility on the Nevada Test Site” was prepared in January. Biological monitoring is prescribed in the facility’s programmatic Environmental Assessment for those chemicals that have either not been tested before, not been tested in large quantities, or for which there are uncertain modeling predictions of downwind air concentrations. The monitoring plan addresses how vegetation and animals will be sampled to determine test impacts under these circumstances and to verify that the spill program complies with pertinent state or federal environmental protection legislation. The plan calls for the establishment of three spatial control transects at three distances from the chemical release point, which have similar environmental and vegetational characteristics as their treatment transect counterparts. The establishment and first sampling of these control transects are currently scheduled for the first quarter of FY97, provided funding is approved.

After approval of the monitoring plan, chemical spill test plans for three experiments were reviewed: (1) Dual Source Experiments using propane and ammonia; (2) KITFOX Add-on Experiments using dibutyl phosphate, kerosene, nitric acid, nitrobenzene, tributyl phosphate, and triethyl phosphate; and (3) KITFOX Add-on Experiment MOROC using hydrochloric acid and nitrogen dioxide. The test plans were reviewed, and it was determined that all experiments would represent minimal risk and no field biological monitoring would be required. Letters documenting these reviews were submitted to the DOE Environmental Protection Division in June and July of 1996.

OFFSITE MONITORING

The HSC was established in the Frenchman Basin in Area 5 as a basic research tool for studying the dynamics of accidental releases of various hazardous materials and the effectiveness of mitigation procedures. The HSC was designed and equipped to (1) discharge a measured volume of a hazardous fluid at a controlled rate on a specially prepared surface; (2) monitor and record downwind gaseous concentrations, operating data, and close-in/downwind meteorological data; and (3) provide a means to control and monitor these functions from a remote location.

The Facility has the capability for releasing large volumes of cryogenic and non-cryogenic liquids at rapid rates through a 500-ft spill line to the experimental area supporting the tank farm. Spill rates for the cryogenic system range from 1,000 to 26,000 gpm with the capability to release the entire contents of both tanks in two minutes. The non-cryogenic system can be released at rates of 500-5,000 gpm with the entire 24,000 gal capable of being released in five minutes.

Test sponsors can vary intake air temperature, humidity, release rate, and release volume in an 8-ft x 16-ft x 96-ft wind tunnel. There are two spill pads available for use in contained open air releases of volumes of 50 - 1,000 gal. Test Area 4 has been added primarily to provide the testing capability for determining the efficacy of totally encapsulated chemical protective suiting materials when exposed to high concentrations of toxic and hazardous gaseous materials.

DOE/NV provides the facilities, security, and technical support, but all costs are borne by the organization conducting the tests. In 1996, four series of tests were conducted involving 28 different chemicals. The plans for each test series were examined by an Advisory Panel that consisted of DOE/NV and EPA's R&IE-LV professional personnel augmented by personnel from the organization performing the tests.

For each test, the R&IE-LV provided an advisor on offsite public health and safety for the Operations Controller's Test Safety Review Panel. At the beginning of each test series and, at other tests depending on projected need, a field monitoring technician from the EPA with appropriate air sampling equipment was deployed downwind of the test at the NTS boundary to measure chemical concentrations that may have reached the offsite area. Samples were collected with a hand-operated Dräger pump and sampling tube appropriate for the chemical being tested. Not all 1996 tests were monitored by R&IE-LV if professional judgement indicated that, based on previous experience with the chemical and the proposed test parameters, NTS boundary monitoring was unnecessary.

The EPA monitors at the NTS boundary, in contact by two-way radio, were always placed at the projected cloud center line.

NON-NTS FACILITY MONITORING

Although permits for the four non-NTS operations (see Table 3.4) included 16 air pollution, 4 wastewater, 4 local hazardous waste generator permits, and 4 hazardous materials permits, effluent monitoring was limited to wastewater discharges at 2 sites (see below). All results from routine monitoring were within the permit limits, and monitoring was limited to the following:

- North Las Vegas Facility (NLVF) - The NLVF self-monitoring report was submitted in October 1996. Two outfalls and the burn pit batch discharge are monitored.

- Remote Sensing Laboratory (RSL) - The Clark County Sanitation District wastewater permit for the RSL required biannual monitoring of two outfalls, quarterly pH, and monthly septage reports. RSL monitoring reports were submitted in May and December 1996.

The Special Technologies Laboratory (STL) holds wastewater permits for the Botello Road and Ekwill Street locations. There is no required self-monitoring.

4.3 ENVIRONMENTAL PERMITS

NTS environmental permits active during 1996, which were issued by the state of Nevada or federal agencies, included 18 air quality permits involving emissions from construction operation facilities, boilers, storage tanks, and open burning; 8 permits for onsite drinking water distribution systems; 1 permit for sewage discharges to lagoon collection systems; 7 permits for septage hauling; 1 incidental take permit for the threatened desert tortoise; and 1 permit for wildlife handling and collection. RCRA Part A and Part B permit applications, based on comments made by the state of Nevada, continued during 1996.

Non-NTS permits included 16 air pollution control permits and 4 sewage discharge permits. Four EPA Generator Identification (ID) numbers were issued to three offsite operations, and four local RCRA-related permits were required at the same three operations.

AIR QUALITY PERMITS

Air quality permits were required for numerous locations at the NTS and at two non-NTS facilities. They are listed in Table 3.4, Chapter 3.

NTS AIR QUALITY PERMITS

Table 4.2 is a listing of state of Nevada air quality operating or construction permits active in 1996. The expiration date indicated in the table for air quality permits to construct, identified with the prefix PC, is identified as "varies," because a permit to construct is generally valid until the time the state performs an inspection and an operating permit is issued.

During 1995, the Bureau of Air Quality began revising all air quality operating permits to meet the new Clean Air Act (CAA) requirements under Title V. The Nevada State Environmental Commission adopted regulations for the establishment of Class I and Class II operating permits. A Class I permit is required for existing and new major sources, incinerator units for solid waste, or affected sources as defined in NAC 445B.289. A major source is defined in the CAA as a source that has the potential (with emission controls) to emit (1) 100 tons or more per year of any one criteria pollutant, (2) 10 tons per year or more of any one hazardous air pollutant, or (3) 25 tons per year of any combination of hazardous air pollutants. A Class II operating permit is required of a source that does not meet the criteria for a major source. To determine whether a source is major or non-major, an emissions inventory must be developed that calculates potential emissions from permitted facilities and “insignificant” activities. A source is determined to be major if the potential emissions as calculated in the inventory meet the above criteria.

An emissions inventory was developed initially by the state of Nevada and then modified by DOE/NV during 1996. The total potential emissions met the criteria for a Class II permit. A Class II permit application for the NTS was originally submitted by DOE/NV to the state in April 1996, prior to development of the emissions inventory. A revised Class II application was submitted in November 1996, and it is anticipated that the Class II permit will be issued in February 1997. When issued, the new permit will replace all existing air quality permits on the NTS, except for the HSC and the open burn permits.

For Open Burn Permit Number 96-27, the Nevada Air Quality Officer must be notified of each burn no later than five days following the burn, either by telephone or written communication. During 1996, two open burns of explosives-contaminated debris were conducted in Area 27. As the Part A and B RCRA permit applications did not include burning of explosives in Area 27, these burn activities were transferred to the Area 11 Explosive Ordnance Disposal (EOD) site that received RCRA permit approval by the state during 1995.

The open burn permit for fire and radiological emergency response training exercises was renewed in October 1996 and issued as Permit Number 97-20. Many of the restrictions in the previous permit, 96-20, were not included in the new permit. Conditions no longer shown on the new permit include the requirement to submit an annual report of training exercises, hours in which exercises must be conducted, the number of training fires to be conducted, and a listing of materials that could not be burned. An annual report of burns was submitted to the state in 1996, which included 12 burn events for radiological emergency response training and 14 fire extinguisher exercises.

The NTS also has a Nevada Hazardous Materials Storage Permit Number 13-94-0034-X, issued by the state Fire Marshall (Table 4.7). This permit is renewed annually when a facility makes a report required by the state's Chemical Catastrophe Prevention Act (see Section 3.1).

In June 1996, a permit was issued for the DOUBLE TRACKS environmental restoration project, located on the Nellis Air Force Range Complex. The permit included a surface disturbance permit, and a site-specific permit attachment for permitted equipment that was relocated from the NTS to Nellis Air Force Range Complex. Upon completion of the DOUBLE TRACKS project in August 1996, a report documenting production amounts and operating hours was submitted to the state.

NON-NTS AIR QUALITY PERMITS

Fifteen air pollution control permits were active for emission units at the Las Vegas Area Operations (LVAO). These permits were issued through the Clark County Health District. Annual renewal is contingent upon payment of permit fees. Permits are amended and revised only if the situation under which the permit has been issued changes. STL has one air pollution control permit. For the other non-NTS operations, no permits have been required or the facilities have been exempted. Table 4.3 lists each of the required permits.

DRINKING WATER SYSTEM PERMITS

Five NTS drinking water system permits issued by the state of Nevada, as shown in Table 4.4, were renewed with new expiration dates. During 1994, the state of Nevada determined that the trucks used for hauling potable water should also have permits, so three additional permits were obtained. These permits were also renewed. No drinking water systems were maintained by non-NTS facilities.

SEWAGE DISCHARGE PERMITS

Sewage discharge permits from the state of Nevada, Division of Environmental Protection are listed in Table 4.5 and require submission of quarterly discharge monitoring reports.

NTS SEWAGE HAULING PERMITS

Permits issued by the state of Nevada Division of Health for six sewage hauling trucks for the NTS were renewed in November 1995 and are listed in Table 4.6.

NON-NTS SEWAGE PERMITS

Sewage permits were required for four locations at non-NTS operations. These included two permits at the LVAO facilities and two at the STL as shown in Table 4.5. Each was issued by the county or local municipality in which the facility was located.

RCRA PERMITS

NTS OPERATIONS

Hazardous waste generation activities at the NTS are performed under EPA Identification

(ID) Number NV3890090001. The NTS continues to be regulated by the 1995 NTS RCRA Hazardous Waste Operating Permit (No. NEV HW009) for the general operation of the facility and the specific operation of the Hazardous Waste Storage Unit and the EOD Unit. Three permit modifications have occurred since October 1, 1996. These modification include changes in the NTS Training Program and personnel changes in the Area 5 and Area 11 Emergency Management Plans. The Pit 3 Mixed Waste Disposal Unit located in the Area 5 RWMS continues to operate under RCRA Interim Status (see Table 4.7).

NON-NTS OPERATIONS

Four EPA Generator ID numbers have been issued to five non-NTS operations. In addition, three local ID numbers were required at one operation. Hazardous waste is managed at all locations using satellite accumulation areas. Three operations have centralized accumulation areas. All hazardous and industrial wastes are transported offsite to RCRA-permitted facilities for approved treatment and/or disposal.

ENDANGERED SPECIES ACT/WILDLIFE PERMITS

Federal and state permits have been issued to DOE/NV and to BN (Table 4.7). These permits are required for the conduct of DOE/NV activities in habitat of the threatened desert tortoise and for the study and collection of this threatened species and other wildlife. (All BN non-NTS facilities are located in existing metropolitan areas and are not subject to the Endangered Species Act.) Annual reports associated with these permits are filed as stipulated in each permit.

DOE/NV activities on the NTS comply with all terms and conditions of a desert tortoise incidental take authorization issued in a Biological Opinion (File Number 1-5-96-F-33) from the U.S. Fish and Wildlife Service (USFWS).

The Nevada Division of Wildlife issued a scientific collection permit to BN (Number S-12888) on January 5, 1996, for the collection and study of various species at the NTS. This permit expired on December 31, 1996.

Table 4.1 Summary of the Onsite Environmental Surveillance Program - 1996

Sample Type	Description	Collection Frequency	Number of Sampling Locations[a]	Type of Analysis
Air	Sampling through Whatman GF/A glass fiber filter and a charcoal cartridge	Weekly	44	Gamma spectroscopy, gross α & ß,($^{238,239+240}$Pu, quarterly composite).
		Monthly	1	Gamma spectroscopy gross α & ß,($^{238,239+240}$Pu quarterly composite).
	Low-volume sampling through silica gel	Biweekly	12	HTO (tritium oxide).
	Low-volume sampling	Weekly	3	^{85}Kr
Tap Water	Grab sample	Monthly	7	Gamma spectroscopy, gross ß, ^{3}H, ($^{238,239+240}$Pu, gross α quarterly), (^{90}Sr annually).
Potable Supply Wells	Grab sample	Quarterly	10	Gamma spectroscopy, gross α & ß, $^{226 \& 228}$Ra, $^{238,239+240}$Pu, ^{3}H enrich. ^{90}Sr
Non-Potable Supply Wells	Grab sample	Quarterly	2	Gamma spectroscopy, gross α & ß, ^{3}H, (^{90}Sr annually) $^{238,239+240}$Pu.
Open Reservoirs[a]	Grab sample	Annually	15	Gamma spectroscopy, gross ß, ^{3}H, $^{238,239+240}$Pu, ^{90}Sr
Natural Springs[a]	Grab sample	Annually	8	Gamma spectroscopy, gross ß, ^{3}H, $^{238,239+240}$Pu, ^{90}Sr
Containment Ponds	Grab sample	Quarterly	1	Gamma spectroscopy, gross ß, ^{3}H, $^{238,239+240}$Pu (^{90}Sr annually)
Sewage Lagoons[a]	Grab sample	Quarterly	9	Gamma spectroscopy, gross ß, ^{3}H, $^{238,239+240}$Pu (^{90}Sr annually)
External Gamma Radiation Levels	UD-814AS thermoluminescent dosimeters	Quarterly	160	Total quarterly exposure

(a) Not all of these locations were sampled because of inaccessibility or lack of water.

Table 4.2 NTS Active Air Quality Permits - 1996

Permit No.	Facility or Operation	Expiration Date
AP9711-0549	Area 1 Facilities:	03/21/00
	Shaker Plant	
	Rotary Dryer	
	Aggregate Plant	
	Concrete Batch Plant	
	Sandbag Facility	
AP9711-0554	Area 6 Facilities:	11/21/99
	Cementing Equip. (silos)	
	Decontamination Facility Boiler	
	Diesel Fuel Tank	
	Gasoline Fuel Tank	
	Slant Screen	
AP9711-0555	Area 23 Facilities:	04/14/96
	Building 753 Boiler	
	Cafeteria Boilers (2)	
	Diesel Fuel Tank	
	Gasoline Fuel Tank	
	Slant Screen	
	NTS Surfaces Disturbances	
	WSI Incinerator	
AP9711-0578	Area 5 Facilities:	05/05/00
	Slant Screen	
AP9711-0664	Navy Thermal Treatment Unit	02/23/01
AP9611-0683	DOUBLE TRACKS Surface Disturbance (TTR)	06/12/01
OP 1975[(a)]	Area 2 Portable Stemming System	12/04/94
OP 1976[(a)]	Area 2 Portable Stemming System	12/04/94
OP 2625	Area 5 Spill Test Facility	11/02/97
OP 2744	Area 12 Cafeteria Boiler	03/23/98
OP 2849	Area 12 Concrete Batch Plant	12/02/98
OP 2850	Area 6 Portable Field Bins	12/02/98
PC 2988	Area 3 Two-Part Epoxy Batch Plant	Varies
PC 3246	Area 3 Mud Plant	Varies
PC 3774	Area 6 Portable Stemming System	Varies
OP 96-20	NTS Open Burn - Training	10/24/96
OP 95-24	Area 4 BEEF Facility	02/29/96

(a) Permits renewal submitted.

Table 4.3 Active Air Quality Permits, Non-NTS Facilities - 1996

Permit No.	Facility or Operation	
Las Vegas Area Operation[(a)]		
A38702	Hamada Offset Press, NLVF	02/28/98
A06501	Spray Paint Booth, NLVF	02/28/98
A06505	Time Saver Aluminum Sander, NLVF	02/28/98
A06506	Abrasive Blasting, NLVF	02/28/98
A06507	Trinco Dry Blast with Dry Bag Dust Filters, NLVF	02/28/98
A38701	Spray Paint Booth, NLVF	02/28/98
A06502	Vapor Degreasers #1	02/28/98
A06503	Three Emergency Generators, and Emergency Fire Control Equipment, NLVF	02/28/98
A38703	Emergency Generator, NLVF	02/28/98
A34801	Columbia Boiler Model WL-180, Penthouse #1, RSL	02/28/98
A34802	Columbia Boiler Model WL-90, Penthouse #1, RSL	02/28/98
A34803	4.0 MM BTU Water Heater #2, RSL	02/28/98
A34804	Cummins Emergency Generator and Emergency Fire Control Pump, RSL	02/28/98
A34805	Spray Paint Booth, RSL	02/28/98
A34811	Excimer Laser, RSL	Indef.
Special Technologies Laboratory[(a)]		
8477	Permit to Operate a 12 Gallon Capacity Vapor Degreaser	Indef.

(a) An annual fee is paid on these permits.

Table 4.4 NTS Drinking Water Supply System Permits - 1996

Permit No.	Area(s)	Expiration Date
NY-5024-12NC	Area 1	09/30/97
NY-4099-12C	Area 2 & 12	09/30/97
NY-360-12C	Area 23	09/30/97
NY-4098-12NCNT	Area 25	09/30/97
NY-5000-12NCNT	Area 6	09/30/97
NY-835-12NCNT	Sitewide Truck	09/30/97
NY-836-12NCNT	Sitewide Truck	09/30/97
NY-841-12NCNT	Sitewide Truck	09/30/97

Table 4.5 Sewage Discharge Permits - 1996

Permit No./Location	Areas	Expiration Date
	NTS Permits	
GNEV93001[(a)]	NTS General Permit	01/31/99
	Off-NTS Permits	
Las Vegas Area Operations		
CCSD-032/Remote Sensing Laboratory[(a)]		06/30/97
VEH-112/North Las Vegas Facility[(a)]		12/31/97
Special Technologies Laboratory		
AII-204/ Santa Barbara, California		12/31/98
III-331/ Santa Barbara, California		12/31/98

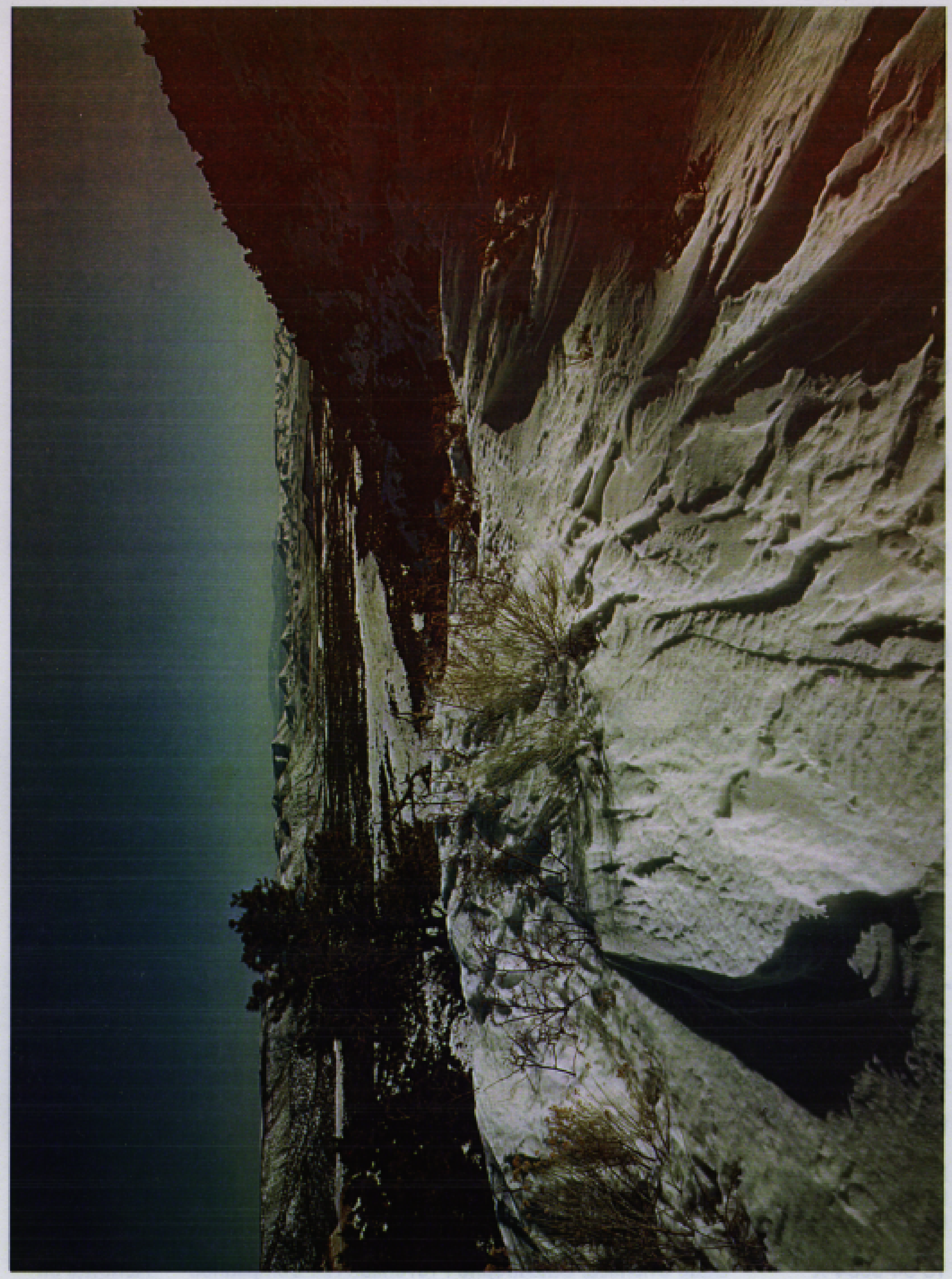
(a) Owner/Operator effluent monitoring required by permit.

Table 4.6 Permits for NTS Septic Waste Hauling Trucks - 1996

Permit Number	Vehicle Identification Number	Expiration Date
NY-17-03311	Septic Tank Pumper E-104573	11/30/97
NY-17-03312	Septic Tank Pumper E-104296	11/30/97
NY-17-03313	Septic Tank Pumper E-105293	11/30/97
NY-17-03314	Septic Tank Pumper E-105299	11/30/97
NY-17-03315	Septic Tank Pumper E-105919	11/30/97
NY-17-03317	Septic Tank Pumper E-105918	11/30/97
NY-17-03318	Septic Tank Pumping Subcontractor Vehicle	11/30/97

Table 4.7 Miscellaneous Permits

Permit	Type and Purpose	Expiration
NEV HW009	RCRA -- General NTS operation: Operation of Two Facilities	05/05/00
File 1-5-96-F-33	USFWS -- Desert Tortoise Incidental Take Authorization	08/00/06
NEV S-12888	Wildlife -- Collection and Study of Species on the NTS	12/31/96
Interim Status	RCRA Part B -- Pit 3 Mixed Waste Disposal Operation	On Permit Approval
13-94-0034-X	State Chemical Catastrophe Prevention Act Compliance	Renewal on report submission



The Northwest Region of the Mesas